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CONCEPT ATTAINMENT AS A FUNCTION OF MONETARY INCENTIVES, COMPETITION, AND INSTRUCTIONS.

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THE MAIN PURPOSE OF THIS STUDY WAS TO COMPARE THE CONCEPT ATTAINMENT BEHAVIOR EFFECTS OF (1) OPTIMAL AND MINIMAL INSTRUCTION, (2) TWO LEVELS OF MONETARY INCENTIVE, AND (3) HIGH AND LOW COMPETITION. EIGHTY COLLEGE STUDENTS WERE GIVEN TWO CONCEPT ATTAINMENT TASKS. ANALYSIS OF VARIANCE WAS USED TO TEST THE EFFECTS OF INSTRUCTIONS, MONETARY INCENTIVES, COMPETITION, SEQUENCE OF CONCEPTS, TYPE OF CONCEPT, ORDER OF CONCEPTS, AND TYPE OF ERROR. IT WAS CONCLUDED THAT THE EFFECT OF INSTRUCTIONS ON CONCEPT ATTAINMENT IS A FUNCTION OF THE TYPE OF INFORMATION PRESENTED. CONCEPT ATTAINMENT WAS DEFINITELY FACILITATED WHEN INFORMATION ABOUT THE NATURE OF CONCEPTS TO BE ATTAINED WAS PROVIDED STUDENTS BEFOREHAND. THE EFFECTS OF THE TWO LEVELS OF MONETARY INCENTIVE AND THE TWO LEVELS OF COMPETITION WERE NOT SIGNIFICANTLY DIFFERENT. IN ADDITION, NEITHER THE CONCEPT TYPE USED IN THESE EXPERIMENTS NOR THE SEQUENCE OF THESE CONCEPTS HAD SIGNIFICANT EFFECTS. (GD)

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RESEARCH AND DEVELOPMENT
CENTER FOR LEARNING
AND RE-EDUCATION

UNIVERSITAS WISCONSINENSIS STUDIUM

RESEARCH
CLR
DEVELOPMENT

Technical Report No. 8

CONCEPT ATTAINMENT AS A FUNCTION OF MONETARY INCENTIVES, COMPETITION, AND INSTRUCTIONS

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Based on a master's thesis under the direction of

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PREFACE

The primary goal of the Research and Development Center for Learning and Re-Education is to improve cognitive learning in children and adults commensurate with good personality development. In the program of research at the Center, we have identified classes of variables and have organized the classes into a taxonomy of variables as outlined in Technical Report No. 1 of the Center.

This technical report is based on the master's thesis of Patricia Kalish. Thesis committee members were Herbert J. Klausmeier, Chairman; Thomas Johnson; and Theodore Harris.

In this study, Patricia Kalish describes a study of variables from two major classes, instructions and motivation, using both incentives and competition for motivation. The instructions, designed to aid the S recognize that there was a concept to be attained, facilitated concept attainment, confirming the results of other studies in which instructions variables have been manipulated. Neither a competitive condition nor monetary incentives increased concept learning level. Further experimentation will be necessary to determine whether these variables do in fact have no effect on concept attainment.

Herbert J. Klausmeier
Professor of Educational Psychology
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ABSTRACT

The three main purposes of this study were to compare the effects of optimal and minimal instructions on concept attainment behavior, to compare the effects of two levels of monetary incentive on concept attainment behavior, and to compare the effects of high and low competition on concept attainment behavior.

Eighty university students participated in five-member groups under 16 different treatment combinations involving sequence, type of instructions, level of incentives, and level of competition.

All Ss were given two concept attainment tasks. Each task consisted of identifying a two attribute conjunctive concept from a series of six presentation slides and then classifying a series of 20 test items as being exemplars or non-exemplars of the concept. The number of errors made in the classification task served as the dependent variable.

An analysis of variance, based on Ss' error scores, was used to test the effects of instructions, monetary incentives, competition, sequence of concepts, type of concept, order of concepts, and type of error.

The instructions in this experiment, one set of which was designed to make certain that the S recognized that he was to attain a concept, facilitated concept attainment. The effects of the two levels of monetary incentive or the two levels of competition were not statistically significant. Neither the concept type nor the sequence of concepts had significant effects. The significantly fewer number of errors made on the second concept was interpreted as indicating positive transfer from the first concept to the second.

I

INTRODUCTION

The amount of research in education and psychology which has dealt with concept attainment has accelerated rapidly in the last decade. Experiments have been conducted in which numerous aspects of concept attainment have been studied, including the effect of instructions on concept attainment. The results of research in this area are contradictory. Archer, Bourne, and Brown(1955) found that instructions had no significant effect on subjects' concept attainment. However, Klausmeier, Harris, and Wiersma (1964) and Underwood and Richardson (1956) found that instructions facilitated subjects' performance on a concept attainment task. Osler and Wei s (1962) found that the effect of instructions differed according to the intelligence level of the subjects. These diverse results indicate that further investigation of the effects of instructions on concept attainment is needed.

Another area in education and psychology which has come under extensive investigation is that of motivation. The studies in this area encompass a broad range, including inquiries on the effects of competition and incentives. The results of this research have also been contradictory. Bergum and Lehr (1964) and Holston (1951) found that monetary incentives significantly improved performance, while Buckner (1959), Burday (1953), and Crawford and Sidowski (1964) found that monetary incentives had no effect on performance.

The effects of competition, which can be described as manipulation of motivation, are also unclear. Church (1964) found that competition improved performance significantly. Mogar (1963) and Pavlik (1958) found that competition had no effect on subjects' performance. However, Shaw (1960) found that competition had a significantly detrimental effect on performance. These widely discrepant results indicate that additional research also should be done on the effects of competition and incentives.

Although concept attainment and motivation separately have been the object of much experimentation, there are few studies which investigated the effects of motivation variables on concept attainment. This limited number of studies primarily has been concerned with the effect of reinforcement on concept attainment. Additional research on the effect of other motivation variables on concept attainment seems to be indicated.

With recognition of the lack, or the diversity, of research results in these three areas, an investigation of the effects of incentives, competition, and instructions on concept attainment takes substance as a worthwhile endeavor.

This study is an attempt to further clarify the relationship between instructions and concept attainment. The results of this study can be compared with the findings of previous research and can be added to the body of evidence accumulating on the effects of instructions on concept attainment.

In addition this study explores the relationship between selected motivation variables and concept attainment. Comparisons between this study and others involving competition or incentives will be difficult because very few of the latter studies have been concerned with concept attainment tasks. While few applications can be made to a practical classroom situation because of the limited nature of the study, it is hoped that this study will be useful in pointing out areas which need further experimentation.

The specific purposes of the present study were:

1. To compare the effects of optimal and minimal instructions on concept attainment behavior.

2. To compare the effects of two levels of monetary incentive on concept attainment behavior.

3. To compare the effects of high and low competition on concept attainment behavior.

II

REVIEW OF RELATED LITERATURE

In this chapter three types of studies will be reviewed: studies relating to the effects of instructions on concept attainment, studies relating to the effects of incentives on human learning, and studies relating to the effects of competition on human learning.

INSTRUCTIONS

Research on the effects of instructions on concept attainment has yielded conflicting results. However, the majority of studies indicate that instructions which provide knowledge about either the nature of the concepts or strategies facilitate concept attainment.

Klausmeier, Harris, and Wiersma (1964) investigated the effects of minimal, structure, and conservative instructions upon efficiency of concept attainment as measured by time to criterion. Conservative instructions which presented information about a strategy facilitated concept attainment significantly more than did minimal instructions. There were no other significant differences between the effects of the three types of instructions.

An experiment by Underwood and Richardson (1956) also investigated the effects of instructions on a concept attainment task, utilizing unrestricted instructions which presented no information about the nature of the concepts, partially restricted instructions which presented the class of responses needed to form the concepts, and completely restricted instructions which presented the six correct concepts. It was concluded that subjects tended to acquire concepts more rapidly as they were given more information about the nature of the concepts to be learned.

Laughlin (1964) compared the effects of instructions emphasizing speed and the effects of instructions emphasizing minimum choices on subjects' attainment of concepts. The analysis of data revealed that although the two groups did not differ significantly in number of card choices made, the group receiving the instructions emphasizing speed did attain the concepts significantly faster. As the instructions did not differ in information presented about the nature of the concepts, results of this study are not directly applicable to the present experiment.

Osler and Weiss (1962) investigated the effects on concept attainment of two types of instructions (general and specific) at two levels of intelligence. The results indicated that under general instructions subjects of superior intelligence attained a first concept more effectively as measured by number of errors, number of subjects who achieved the criterion of success, and number of subjects who verbalized the concept correctly. However, in attaining a second concept under specific instructions, subjects of average intelligence improved, while subjects of superior intelligence remained the same. Because the two types of instructions were not clearly defined, it is difficult to generalize these results to other studies investigating the effects of instructions.

Archer, Bourne, and Brown (1955) investigated the effects of analytic and nonanalytic instructions presented prior to the second of a series of concept attainment tasks. Instructions had no significant main effects on time to criterion, number of correct and incorrect responses, and efficiency of concept attainment behavior. There were, however, significant interactions involving instructions which led the authors to conclude that instructions reduced variability and facilitated performance on the more complex tasks.

In summary, results of these studies have not been unanimous concerning the effects of instructions. One purpose of the present study is to investigate further the effects of instructions which present information about the nature of the concepts on concept attainment tasks.

INCENTIVES

Although an extensive number of experiments have investigated the effects of monetary

incentives on human learning and performance, few studies have been concerned with the effects of monetary incentives on concept attainment.

A number of studies have shown that performance on simple reaction tasks is facilitated by monetary incentives. Meyer, Bahrick, and Fitts (1954) found that monetary incentives significantly increased the eye blink rate of subjects. In an investigation of the effects of monetary incentives on visual vigilance, Bergum and Lehr (1964) found that giving subjects 20¢ for every signal seen and deducting 20¢ for every signal missed significantly facilitated vigilance. Holston (1951) investigated the effects of monetary incentives on visual discrimination and found that increased incentives resulted in a lowered intensity discrimination threshold for a point source of light.

In a study involving a more complex task, Pavlik (1958) found that offering $15 to the group of subjects who built the most triangular models had no significant effect on the number of models constructed.

Studies involving cognitive tasks have generally found that monetary incentives have no effect on learning. However, there are some studies which have yielded contradictory results.

Miller and Estes (1961) were concerned with the effects of monetary rewards (1¢ versus 50¢) on discrimination learning. They found no significant difference, due to the two levels of incentive, in the number of errors made.

Kausler and Trapp (1962) investigated the effects of incentives on relevant and irrelevant learning of a serial learning task. Half of the subjects were told they would be paid between 50¢ and $2.50 depending on the number of errors made during each trial. No incentive instructions were presented to the other subjects. No significant main effects were found due to incentives, although significant interactions were found between incentives, relevant and irrelevant cues, and position of cues.

Kausler, Laughlin, and Trapp (1964) further investigated the effects of incentives on relevant and irrelevant learning of younger subjects on a serial learning task and found that incentives, ranging from 25¢ to $1.50, significantly facilitated only irrelevant learning.

When Birch (1960) investigated the effects of an increase in monetary incentive on a complex verbal learning task, consisting of learning the correct response JIX or DAC to each of 40 stimuli made up of letter pairs and number pairs, he found that an increase of $1 significantly improved performance on test trials. However, he did not manipulate incentives prior to the learning task.

Spitzer (1962) undertook an investigation of the effect of offering 10 German marks to the group of subjects which performed the best on intelligence and concentration tests. Only the results of the test of concentration revealed a facilitating effect of the intensified motivation.

The only study found which investigated the effects of monetary incentives on concept attainment was one conducted by Burday (1964). He compared the performance of schizophrenic, brain-damaged, and non-psychiatric patients on two concept attainment tasks of the block sorting type. He also considered the effects of positive motivation, consisting of the offer of money, on each group's performance on the second task. No differences were found in performance scores or verbal scores, due to the motivational treatment, nor was there any interaction effect between motivational treatment and diagnostic group.

The studies reviewed in relation to incentives have differed in nearly every aspect of experimentation. Subjects have ranged from elementary school children to college students. the tasks have ranged from eye blinking (Meyer et al., 1954) to performance on an intelligence test (Spitzer, 1962). Incentives have been offered prior to learning the first task (Miller & Estes, 1961; Kausler & Trapp, 1961), between learning trials (Burday, 1964), prior to test trials (Spitzer, 1962), and between test trials (Birch, 1960). The amount of monetary incentive offered has ranged from 1¢ (Miller & Estes, 1961) to $15 (Pavlick, 1958). Performance has been measured in number of errors (Miller & Estes, 1961; Kausler & Trapp, 1962), number of models made (Pavlik, 1958), total number of responses (Meyer et al., 1954), number of correct responses (Kausler, Laughlin, & Trapp, 1964) and so forth.

In spite of the diversity in experimentation investigating the effects of monetary incentives, certain general trends in results can be observed. Studies involving reaction tasks have tended to find a facilitative effect due to incentives while studies involving cognitive learning have tended to find no effects due to monetary incentives. A second aspect of this study will attempt to determine whether or not increased monetary incentives will facilitate performance on a concept attainment task.

COMPETITION

Research on competition has generally centered on comparing the effects of competition and cooperation on a variety of tasks. Little research has been done comparing the effects of competition and non-competition, and no studies were found which investigated the effects of competition on a concept attainment task.

Competition was found to lower reaction time in an experiment conducted by Church (1964). Subjects in the non-competitive treatment were told to pull a toggle switch as fast as possible, while subjects in the competitive treatment were told to compete with their partners. An analysis of the data indicated that competitive instructions significantly lowered reaction time. In a second experiment involving the same reaction time task, Church found that competitive instructions again significantly lowered reaction time but also increased the number of errors made by the subjects under the competitive conditions.

Mogar (1962) found no significant difference in the number of errors made in a perceptual motor task under conditions of competition and under conditions of non-competition. However, Mogar analyzed the number of errors made by individuals under the two conditions and found that the performance of some subjects was impaired under the competitive situation while other subjects' performance was facilitated.

The effects of competition and cooperation on college students' performance in a game situation were investigated by Crawford and Sidowski (1965). The results indicated that cooperative groups learned to make significantly more points than the competitive groups. The experimenters hypothesized that the competitive subjects were trying to prevent other subjects from making points as well as trying to make points for themselves. Therefore, their performance was inhibited.

Miller and Hamblin (1964) studied the effects of differential rewarding on productivity in a game situation and found that differential rewarding conditions which stressed competition significantly inhibited performance as measured by time to solution. However, when the interaction between differential rewards and task independence was analyzed, the effects of differential rewards were very weak on performance in tasks where the solution to the problem did not depend greatly on subjects' sharing their clues.

Deutsch (1950) was concerned with the effects of cooperation and competition upon group processes in a discussion type problem. Observers rated the performance of both groups and while the cooperative group was rated higher in some areas, such as number of ideas presented, there were no significant differences between groups in the amount of learning.

Grossack (1954) also investigated the effects of competition and cooperation on group behavior in a discussion of a case study. The cooperative group was found to display more cohesive behavior. However, no measure of learning was taken in this study.

In a study investigating the effects of cooperation and competition on a problem-solving task, Raven (1964) found that triads in a cooperative treatment were able to solve the problem of leveling a triangular table significantly faster than triads in a competitive treatment.

Shaw (1958) investigated the effects of competition, cooperation, and independence on a psychomotor tracking task. The results indicated that subjects in a cooperative situation performed the most efficiently, as measured by time on target and number of integrated errors, while subjects in the competitive situation performed the least efficiently. Shaw hypothesized that the competitive subjects did less well because they were trying too hard.

In a second experiment Shaw changed the task to one involving memory and reasoning. Subjects in three motivational situations similar to those in the first experiment were to learn the sequence of pressing buttons in order to turn on four lights. Competitive subjects performed less effectively but no significant difference was found between the cooperative and individual situations.

Wilson (1965) in his investigation of the effects of competition on the speed and accuracy of syllogistic reasoning of college students found that competition exerted a significant effect on both time and error scores. Competitive subjects took more time to solve problems but made fewer errors.

The studies reviewed in relation to competition have differed in many aspects. This great diversity makes it difficult to draw any generalizations from the results of these studies to concept attainment. A third aspect of this study will attempt to determine the effects of competition on a concept attainment task.

III
METHOD

EXPERIMENTAL DESIGN

Measures of performance were obtained from each S on two concept attainment tasks. Ordinal position and sequence effects were balanced by placing the two concept attainment tasks into the 2 x 2 Latin square. Sequences were on the rows of the square, ordinal position on the columns and type of concept attainment task within the square. There were eight treatment combinations formed by the three two-level variables (optimal and minimal instructions, high and low incentives, high and low competition) and the 2 x 2 Latin square was replicated five times under each treatment combination. Therefore there were five Ss nested in each of the 16 sequence-instruction-motivation-competition cells.

SUBJECTS

The Ss were 80 paid volunteers drawn from two beginning courses in educational psychology at the University of Wisconsin. Seventy-two females and eight males participated in the experiment. The median age of the Ss was 22.

EXPERIMENTAL MATERIALS

The materials and instructions used in this experiment were developed by Fredrick (1965).

The stimulus materials were two series of colored slides containing geometric figures which varied in value for each of five attributes. The attributes and their corresponding values were:

number of figures.....one or two
color of figures.....red or green
texture of figures..... plain or textured
shape of figures..... circular or square
size of figures.....large or small

The first six slides of each series uniquely determined a two-attribute concept (Red Circle and Two Textured) of the type described by Bruner, Goodnow, and Austin (1956) as conjunctive. The first slide was a positive instance of the concept and each of the following slides varied only one attribute from the first. Positive instances of the concepts were labelled YES and negative instances of the concept were labelled NO.

The last ten slides of each series contained test items, two per slide, which were labelled with alphabetical letters. The test items following the concept Red Circle consisted of six positive and 14 negative instances of that concept. The test items following the concept Two Textured consisted of seven positive and 13 negative instances of that concept. None of the instances used in the test series had been shown in the presentation series.

A three-page booklet consisting of task instructions and two response sheets was also used in this experiment.

EXPERIMENTAL PROCEDURE

Subjects volunteered for the experiment and were informed that they would be given an opportunity to earn an unspecified amount of money as a result of their participation. The Ss listed hours they would be available and then were scheduled in groups of five at their convenience. Each group was randomly assigned to one of 16 experimental treatments.

After reporting to the experimental room, Ss were seated in front of a screen, each S in a position assuring maximum visibility of the screen and minimum visibility of other Ss. The Ss were then read one of four sets of instructions. For the non-competitive, low incentive groups the instructions were:

> In this experiment you will be given an opportunity to earn some money. You will be shown two series of slides. After each series, you will be asked questions about these slides. The amount of money you earn will depend on how well you answer the questions. The amount you earn depends only on your score and can vary from $1.25 to nothing. If you answer at least 80 % of all the questions correctly you will

receive $1.25. If you answer at least 65% of the questions correctly you will receive $1.00. If you answer at least 50% of the questions correctly you will receive 75¢. If you answer at least 35 % of the questions correctly you will receive 50¢, and if you answer only 20% of the questions correctly you will receive 25¢. Thus it would be possible for all of you to receive $1.25 if each of you answers enough questions correctly.

The Ss in the competitive, low incentive condition received the following instructions:

In this experiment you will be given an opportunity to earn some money. You will be shown two series of slides. After each series you will be asked questions about these slides. The amount of money you earn will depend on how well you answer the questions in relation to the rest of the group. Each member of this group will receive a different amount of money. The amount you receive will be determined by comparing your performance with that of the other group members. The member whose performance is judged best will receive $1.25. The member whose performance is judged second best will recieve $1.00. The member whose performance is judged third best will receive 75¢. The member whose performance is judged fourth best will receive 50¢ and the member of this group whose performance is judged the poorest will receive 25¢.

Subjects in the high incentive conditions received similar instructions except that the amounts of money were doubled.

Subjects were then given answer booklets, and were requested to supply the following information: name, age, sex, year in school, major, and summer address.

All Ss were asked to read the task instructions in their booklets as the experimenter read them aloud. Subjects received one of two sets of task instructions. Those Ss in the optimal instructions treatment received the following instructions:

In this experiment you are going to identify concepts that I have in mind. A concept, in this experiment, is used to classify sets of cards into 2 groups, one set belongs to the concept and the other set does not. Let's clarify further how we are using the term concept. Here is a card with one large textured green square. Suppose that I told you "yes," meaning the card belongs to the concept I have in mind. This would tell you that the concept I have in mind might be large square, or one large, or one textured, or green textured, or any other combination of features of the card. You would need more cards, however, to tell exactly what the concept is. Suppose I presented a second card that was identical to the first one except that it had one small textured green square, instead of one large textured green square. If I told you "no," meaning this card does not belong to the concept, you could infer that all cards that are small do not belong to the concept. The third card I present might be identical to the first one except that it contained a circle instead of a square. I might tell you "yes" meaning it does belong to the concept. Still other cards would be needed to tell exactly what the concept is. Thus, concepts in this experiment are combinations of the features of the cards and are used to classify sets of cards. After seeing a series of cards you can decide what the concept is; you can tell which cards do and do not belong to the concept. The label below each card will tell you which are in the concept.

You are going to see slides which have geometric figures on them. Some of these figures will be circles and some will be squares. The figures can be large or small, red or green, solid or textured. There can either be one circle or two circles, or one square or two squares on a slide. For example, look at this slide. We could describe it as two, large, plain, green, square figures. Now will you please describe the next figure.

We will show you a series of six slides. Please watch closely. We will ask you questions about them. Do not write; do not turn the page now.

The Ss in the minimal instruction treatment received the following instructions:

You are going to see slides which have geometric figures on them. Some of these will be circles and some will be squares. The figures can be large or small, red or green, plain or textured. There can either be one circle or two circles, or one square or two squares on a slide. For example, look at this slide. We could describe it as

two, large, plain, green, square figures. Another slide might be this one. It is one, small, textured, red, circular figure. Now will you please describe the next figure.

We will show you a series of six slides. Please watch closely. We will ask you questions about them. Do not write; do not turn the page now.

While the instructions were read, three slides were shown to the Ss. Two slides were used to illustrate the five attributes and their corresponding values. The Ss were asked to write a description of the third slide to demonstrate their understanding of the attributes and values. After the Ss wrote their description, the experimenter read the correct description of the slide in order for the Ss to check their responses.

Subjects were reminded of the competitive-incentive conditions appropriate to their particular treatment group and then were shown a series of six slides, each of which was exposed for ten seconds.

Subjects were then told they were to be shown a series of slides without YES or NO labels, and their task would be to decide, on the basis of the six slides they had just seen, which slides should be labelled YES and which slides should be labelled NO. On their response sheet they were to circle letters of the figures which should be labelled YES. Subjects were shown the test slides at a constant exposure of ten seconds.

Following their viewing and categorizing of the test slides, Ss were asked to write a description of the slides they had circled and a description of the task. Four minutes were allotted for the answering of these two questions.

Subjects were then told they would have a new problem. They were reminded of the appropriate competitive-incentive conditions and were shown the second series of presentation and test slides. After the experiment, Ss were asked not to divulge either the nature of the task or how much money they received as a result of participation in the experiment.

DEPENDENT VARIABLE

The measurement of Ss' performance was number of errors of which there were two types: errors of omission (not circling letters of positive instances of the concepts), and errors of commission (circling letters of negative instances of the concept).

A secondary analysis was computed on number of responses (total number of letters circled).

IV

RESULTS AND DISCUSSION

An analysis of variance of subjects' scores based on number of errors (see Table 1) yielded statistically significant main effects of instructions ($p < .05$), ordinal position in sequence ($p < .05$), and type of error ($p < .05$). The main effects of level of monetary incentives, level of competition, sequence of concepts, and type of concept were not statistically significant. The type of error × level of competition × level of monetary incentive interaction was significant ($p < .05$) as was the type of error × level of monetary incentive × type of instruction interaction ($p < .01$). No other interaction approached significance.

Table 1

Analysis of Variance of Error Scores

Source	SS	df	MS	F
S. Sequence	6.05	1	6.05	< 1
I. Instructions	30.01	1	30.01	4.63*
M. Incentives	.11	1	.11	< 1
C. Competition	.45	1	.45	< 1
S × I	.32	1	.32	< 1
S × M	.32	1	.32	< 1
S × C	.45	1	.45	< 1
I × M	9.81	1	9.81	1.51
I × C	4.52	1	4.52	< 1
M × C	7.82	1	7.82	1.21
S × M × I	2.43	1	2.43	< 1
S × C × I	.60	1	.60	< 1
S × C × M	4.50	1	4.50	< 1
I × M × C	2.43	1	2.43	< 1
I × M × C × S	2.48	1	2.48	< 1
Ss/IMCS	414.72	64	6.48	
P. Type of Error	22.05	1	22.05	5.35*
P × S	9.80	1	9.80	2.38
P × I	9.12	1	9.12	2.21
P × M	.02	1	.02	< 1
P × C	2.45	1	2.45	< 1
P × I × M	28.78	1	28.78	6.99**
P × C × I	1.50	1	1.50	< 1
P × C × M	17.10	1	17.10	4.55*
P × I × S	3.60	1	3.60	< 1
P × M × S	0	1	0	< 1
P × C × S	1.25	1	1.25	< 1
P × I × M × C	7.23	1	7.23	1.76

Table 1, Continued

Source	SS	df	MS	F
P × I × M × S	4.08	1	4.08	< 1
P × I × C × S	9.13	1	9.13	2.22
P × M × C × S	1.03	1	1.03	< 1
P × I × M × C × S	.16	1	.16	< 1
P × Ss/IMCS	263.7	64	4.12	
O. Order	39.20	1	39.20	5.22*
T. Type of Concept	18.05	1	18.05	2.40
O × I	.12	1	.12	< 1
O × M	.12	1	.12	< 1
O × C	.45	1	.45	< 1
O × P	8.45	1	8.45	1.13
T × I	9.12	1	9.12	1.21
T × M	1.02	1	1.02	< 1
T × C	11.25	1	11.25	1.50
T × P	7.20	1	7.20	< 1
O × M × I	.78	1	.78	< 1
O × C × I	0	1	0	< 1
O × C × M	.60	1	.60	< 1
O × I × P	1.50	1	1.50	< 1
O × M × P	0	1	0	< 1
O × C × P	1.25	1	1.25	< 1
T × M × I	4.03	1	4.03	< 1
T × C × I	.30	1	.30	< 1
T × C × M	.10	1	.10	< 1
T × I × P	5.50	1	5.50	< 1
T × M × P	4.50	1	4.50	< 1
T × C × P	.05	1	.05	< 1
I × M × C × O	.08	1	.08	< 1
I × M × C × T	.08	1	.08	< 1
T × M × I × P	.48	1	.48	< 1
T × C × I × P	.13	1	.13	< 1
T × C × M × P	1.03	1	1.03	< 1
O × M × I × P	.23	1	.23	< 1
O × C × I × P	1.53	1	1.53	< 1
O × C × M × P	.13	1	.13	< 1
P × I × M × C × O	.16	1	.16	< 1
P × I × M × C × T	.16	1	.16	< 1
Residual	961.40	128	7.51	
Total	1279.20	319		

* $p < .05$
** $p < .01$

A tabular presentation of all error scores is in the Appendix to the thesis on which this report is based (Kalish, 1965).

Mean error scores for the two instruction groups are shown in Table 2. Ss in the optimal instructions condition tend to obtain lower mean error scores than Ss in the minimal instructions condition. Although this finding corresponds to the results obtained by Klaus-

Table 2

Mean Error Scores for Instructions

Instructions	Errors
Optimal	1.99
Minimal	3.21

meier, Harris and Wiersma (1964) utilizing similar instructions on a different concept attainment task, it somewhat contradicts the results obtained by Archer, Bourne, and Brown (1955) and Osler and Weiss (1962). However, these contradictory results may be due to differences in the type of information presented in the various instructions. It appears from the present experiment that presenting information about the nature of the concepts whereby the S recognizes that there is a concept to be attained significantly facilitates performance in concept attainment. It should be noted that there was no significant instructions × type of error interaction which indicates that instructions did not have any differential effect on the type of errors committed. It is also interesting to note that there was no significant instructions × order interaction, indicating that the effect of instructions persisted beyond the first concept and was not diminished by the practice effect of attaining a first concept.

No significant differences were found between the mean error scores of Ss in the high and low monetary incentive conditions. This finding is not unexpected as it corresponds to the results obtained by Miller and Estes (1961) utilizing a discrimination task, Kausler and Trapp (1962) utilizing a serial learning task, and Burday (1964) utilizing a concept attainment task. Therefore it is likely that varying amount of monetary incentive does not have any inordinate effect on performance in a concept attainment task, although it is also possible that this result may be due to ineffective manipulation of incentives through verbal instructions.

No significant differences were found between the mean error scores of Ss in the high and low competitive conditions, which would tend to support the hypothesis of Miller and Hamblin (1964) that competition does not affect performance on means-independent tasks, i. e., tasks in which success does not require interaction with other Ss. However, this finding contradicts the results obtained by Shaw (1958) who found that competition inhibited performance, and the results obtained by Wilson (1965) who found competition facilitated performance. It may be that the competition instructions in the present experiment were not sufficiently intense to either inhibit or facilitate performance on the concept attainment task.

Mean error scores for the two ordinal positions in sequence are shown in Table 3. Subjects tended to obtain higher mean error scores on the first concept than on the second. This

Table 3

Ordinal Position	Errors
First	3.30
Second	1.90

Table 4
Mean Error Scores for Type of Error

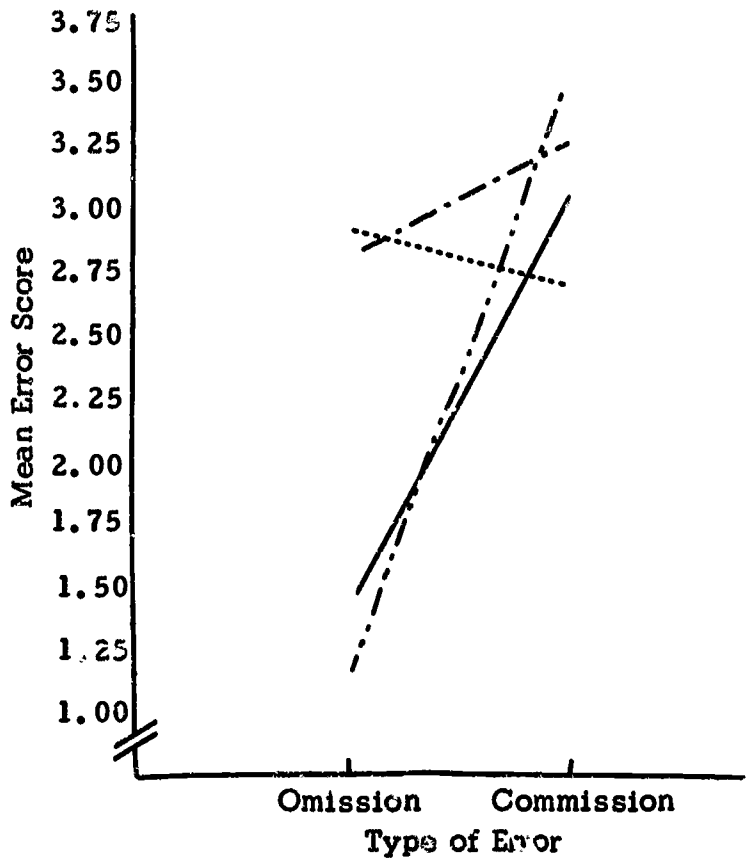
Type of Error	Errors
Omission	2.08
Commission	3.13

probably indicates that performance on the first concept attainment task had a positive transfer effect on the second task, even though the Ss received no feedback on the quality of their performance. However, since the present experiment used only two two-attribute conjunctive concepts, the generality of this finding is limited.

Mean error scores for the two types of error are shown in Table 4. Subjects tended to obtain higher mean error scores on errors of commission than on errors of omission. This is likely to be due to the fact that there were more opportunities for Ss to make errors of commission than errors of ommission.

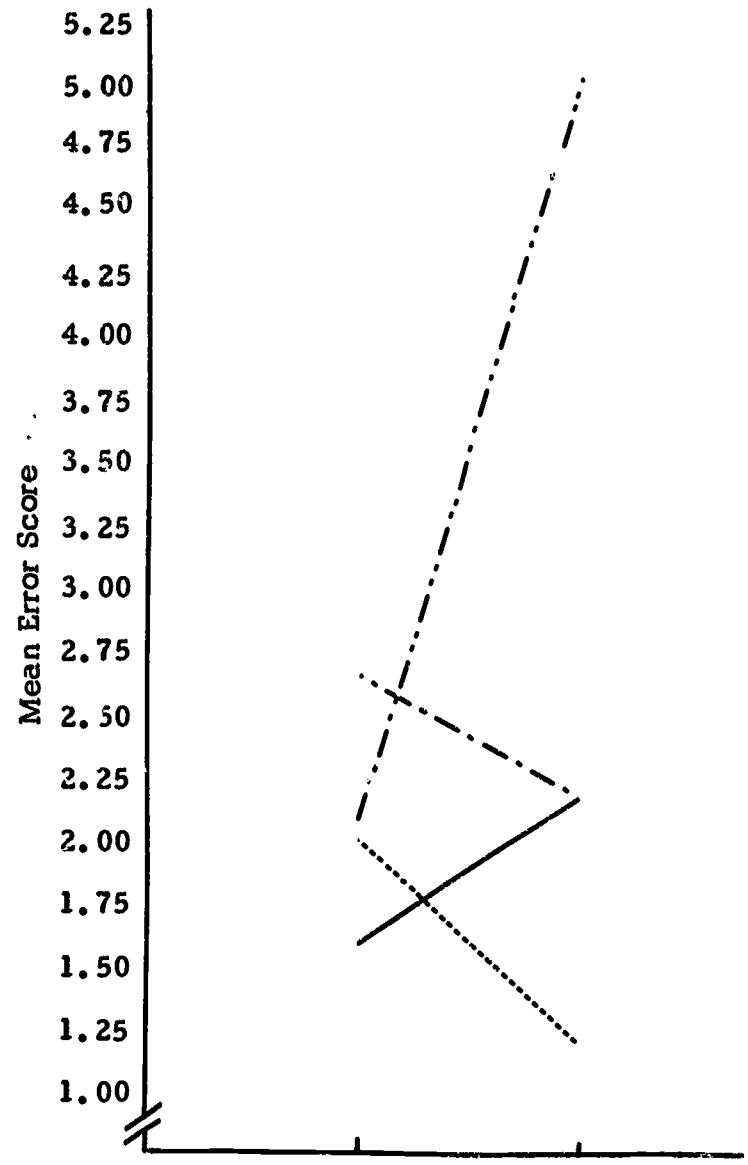
The significant interaction of type of error, level of competition, and level of monetary incentives is depicted in Figure 1. Subjects in the low competitive, high incentive treatment made fewer errors of omission but more errors of commission as compared with Ss in the low competitive, low incentive treatment. Subjects in the high competitive, high incentive treatment made more errors of omission but fewer errors of commission as compared with Ss in the high competitive, low incentive treatment. This interaction would seem to indicate that specific combinations of monetary incentives and competition are having a differential effect on the type of errors committed.

The mean error scores for the significant type of error × level of competition × level of monetary incentives interaction are graphed in Figure 2. Subjects in the high monetary incentive, minimal instructions treatment made more errors of omission but equal errors of commission as compared to Ss in the high in-



——— Low competition, high incentives
····· Low competition, low incentives
—·—· High competition, high incentives
—··— High competition, low incentives

Fig. 1. Interaction of type of error, level of monetary incentives and level of competition.



———Optimal instructions, high incentive
·····Optimal instructions, low incentive
—·—·Minimal instructions, high incentive
—··—Minimal instructions, low incentive

Fig. 2. Interaction of type of error, level of monetary incentives and type of instruction.

centive, optimal instructions treatment. Subjects in the low incentive minimal instructions treatment made almost the same number of errors of omission but many more errors of commission than Ss in the low incentive, optimal instructions treatment. This interaction would seem to indicate that specific combinations of monetary incentives and instructions are also having a differential effect on the type of errors committed.

Both interactions could be explained if the various treatments were having certain effects on the quantity of responses made. This would be related to the number of errors made, since as Ss made many responses, they would have a tendency to make more errors of commission than errors of omission. When Ss made very few responses, they would have a tendency to make more errors of omission than errors of commission. In order to test this possibility, a separate analysis of variance was computed on the total responses made by the Ss. (See Table 5.) Although none of the main effects were statistically significant, the level of monetary incentive × type of instructions interaction was significant ($p < .05$) and the competition × level of monetary incentive interaction approached significance ($p < .10$).

The mean response scores for the monetary incentive × type of instruction interaction are presented in Table 6. Subjects in the optimal instructions, high monetary incentives condition made more responses than Ss in the optimal instructions, low monetary incentives

Table 5

Analysis of Variance of Total Response Scores

Source	df	SS	MS	F
S. Sequence	1	25.32	25.32	1.55
I. Instructions	1	25.32	25.32	1.55
M. Incentives	1	0.62	0.62	< 1
C. Competition	1	3.61	3.61	< 1
S × C	1	2.81	2.81	< 1
S × M	1	2.11	2.11	< 1
S × I	1	21.01	21.01	1.29
C × M	1	49.61	49.61	3.04**
C × I	1	10.51	10.51	< 1
M × I	1	94.61	94.61	5.80*
S × C × M	1	6.62	6.62	< 1
S × C × I	1	25.32	25.32	1.55
S × M × I	1	23.12	23.12	1.42
C × M × I	1	37.82	37.82	2.32
S × C × M × I	1	0.02	0.02	< 1
Error S/SCMI	64	1043.58	16.30	
Total	79	1371.99		

*p < .05
**p < .10

condition, while Ss in the minimal instructions high monetary incentive condition made fewer responses than Ss in the minimal instructions, low monetary condition.

The results of this analysis lend support to the hypothesis that certain combinations of monetary incentives with levels of competition and types of instructions cause an increase in the number of responses made by Ss.

Table 6

Mean Response Scores for Level of Monetary Incentive × Type of Instruction Interaction

Condition	Error
Optimal Instructions, High Incentive	14.55
Optimal Instructions, Low Incentive	12.55
Minimal Instructions, High Incentive	13.50
Minimal Instructions, Low Incentive	15.85

V

CONCLUSIONS

In this chapter, conclusions drawn from the results of this experiment are presented and related to previous experiments. The discussion treats the variables in the following order: instructions, incentives, competition, type of concept, sequence of concepts, ordinal position in sequence, and type of error.

INSTRUCTIONS

While instructions may seem to be a relatively straightforward variable in studies of this kind, many problems are yet to be resolved. Gagné (1965) lists eight categories of information which may be conveyed by instructions. It is plausible that each type of information may have a different effect on concept attainment which could account for the discrepancies in results of studies investigating the effects of instructions on concept attainment.

In Gagné's classification scheme, instructions may have the following functions:

1. Presenting the stimulus....
2. Directing attention and other learner activities....
3. Providing a model for terminal performance....
4. Furnishing external prompts....
5. Guiding the direction of thinking....
6. Inducing transfer of knowledge....
7. Assessing learning attainments....
8. Providing feedback

(Gagné, 1965, pp. 268–270).

Since the instructions utilized in the present experiment present information about the nature of the concepts to be attained, they correspond to Gagné's Type 3 classification. The findings of the present study indicate that Ss who receive information about the nature of the concepts to be attained obtain significantly lower error scores than Ss who do not receive this information. This finding corresponds to the results obtained by Underwood and Richardson (1956) who also utilized instructions which presented information about the nature of the concepts to be attained.

Klausmeier, Harris and Wiersma (1964) also found a facilitative effect due to instructions which present information corresponding to Gagné's Types 2 and 5 classifications. Archer, Bourne, and Brown (1956) found no effect due to instructions which present information corresponding to Gagné's Type 5 classification. It might seem profitable to make an analysis of the type of information provided in other studies investigating the effects of instructions.

It may be concluded that the effect of instructions on concept attainment is a function of the type of information presented. Apparently providing information about the nature of the concepts to be attained facilitates concept attainment.

It should be noted that there was no type of instructions × order interaction indicating that the effects of instructions tended to persist through the first concept attainment task. An interesting problem for future research might be an investigation of the duration of the effect of instructions in a longer series of concept attainment tasks.

INCENTIVES

The performance of Ss who received high monetary incentives tended not to differ from the performance of Ss who received low monetary incentives. This finding, which corresponds to the results obtained by Miller and Estes (1961) and Kausler and Trapp (1962), may indicate that various levels of monetary incentives do not differentially affect concept attainment. However, it is also plausible that the two levels of monetary incentives employed in this experiment represent only one range of incentives and are not really different. Therefore this experiment would not test the effects of different levels of monetary incentives. It is also possible that verbal manipulation of incentives was ineffective. Because of these limitations, no conclusions can be drawn from the present experiment about the effects of various levels of monetary incentives on concept attainment.

COMPETITION

The performance of Ss in the competitive treatment did not differ significantly from the performance of Ss in the non-competitive treatment. This finding corresponds to the results obtained by Miller and Hamblin (1964) and may indicate that high and low competition do not effect concept attainment differentially. However, this conclusion may not be plausible because of certain limitations in this study. Ineffective manipulation of incentives would have adversely affected the competitive situation for if the monetary incentives were not perceived as goals, Ss would have no reason to compete. Placing Ss in groups may have caused them to feel competitive, even though the instructions stressed non-competition. Finally, the instructions may not have actually created a competitive situation.

TYPE OF CONCEPT

The results indicated that the concept Red Circle tended to be easier to attain than the concept Two Textured. This effect did not reach statistical significance so it may be concluded that although the two concepts differed in difficulty, this difference did not greatly affect performance on the two tasks. This conclusion must be limited to the specific concepts used in the present experiment.

SEQUENCE OF CONCEPTS

The main effect of sequence of concepts did not reach statistical significance, indicating that the two sequences of concepts were not different in their effects on concept attainment. This conclusion must be limited to the two concepts and the particular stimulus materials used in this experiment as this effect may be due to the similarity of the two concepts.

ORDINAL POSITION IN SEQUENCE

Subjects tended to obtain significantly higher error scores on the first concept than on the second. This probably indicates that performance on the first concept attainment task had a positive transfer effect on performance in the second task. The generality of this finding is limited to two two-attribute conjunctive concepts.

TYPE OF ERROR

Subjects tended to make significantly more errors of commission than errors of omission. However, errors of omission were errors in categorizing positive instances of the concepts and errors of commission were errors in categorizing negative instances of the concept. In each test series there were more negative instances of the concept than positive instances. Therefore, this finding is probably due to the greater frequency of opportunities to make errors of commission.

Two second order interactions were found to be significant. In the type of error × type of instructions × level of monetary incentives intersection, Ss in the high monetary incentive, minimal instructions treatment made more errors of omission but equal errors of commission as compared to Ss in the high incentive, optimal instructions treatment. Subjects in the low incentive optimal instructions treatment made almost the same number of errors of omission but many more errors of commission as Ss in the low incentive, minimal instructions treatment. In the type of error × level of competition × level of monetary incentives interaction, Ss in the low competitive, high incentive treatment made fewer errors of omission but more errors of commission as compared with Ss in the low competitive, low incentive treatment. Subjects in the high competitive, high incentive treatment made more errors of omission but fewer errors of commission as compared with Ss in the high competitive, low incentive treatment. Interpretation of these interactions is unclear, and must be limited due to the small number of subjects in each cell of the design.

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